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would make a better general showing. The problems are more complex than would appear at first sight, and it is here indicated that the data require delicate treatment.

ROLAND P. FALKNER.

THE MECHANISM OF STATISTICS.

The *Journal of the Statistical and Social Inquiry Society of Ireland* for August, 1889, contains an article covering 26 pages upon *The Mechanism of Statistics.* It was originally read before the above-named society by the author, Robert E. Matheson, Esq., Assistant Registrar-General.

Mr. Matheson in his general remarks relating to the statistical processes in use in the office in which he is Secretary says truthfully, "we can best learn our deficiencies by comparison with our neighbors, and in studying the statistical reports of other countries we may find many things in which we are lacking."

The United States has a record in statistical science in keeping with its unexampled progress in other lines, but the older European countries have organized, fostered, and expanded statistical inquiry and publication in a most marked degree. In all this work the mechanism or practical feature of statistics has performed its part, and this paper gives an opportunity to compare statistical methods in this country with those used in the office with which Mr. Matheson is connected.

CHAPTER I relates to the collection of information which, as in this country, is obtained from permanent records kept by government offices; from oral information given to officers or agents, and, as in the case of the Irish census, by information furnished in writing by the public. This latter plan was tried in the Massachusetts State Census of 1875, but, probably from being the first time, it was not a marked success, and was not resorted to in 1885. The plan has never been followed in any United States Census of population, the enumerators always filling in the schedules themselves. As regards the blind, deaf, insane, etc., the usual plan in this country is to record the general fact upon the general schedule and obtain the complete information upon what is called a "special schedule." In Ireland this additional information, called "Secondary Inquiries," is obtained by a second enumeration conducted from the central office, but it is not stated whether this additional information is secured by mail, by special agents or experts, or by both means combined.

CHAPTER II relates to the arrangement of returns. No mention is made of the examination of the returns in the office to see if the enumerators or the people have properly filled the schedules. This examination is a prominent feature in an American statistical office, and schedules would not be advanced to the tabulation stage until expert examination had shown that they were in condition for mechanical tabulation.

CHAPTER III considers tabulation and "summarization," or the process of aggregating totals. In Ireland the enumerators are encouraged and aided to perform part of the work of tabulation. In this country they are not allowed to make even simple aggregations of population, the American idea being that the enumerator's work should be limited to "recording," while the office clerks should do all the tabulations. By "simple extraction" is meant the tabulation of one or more simple points, such as number of each sex. By "compound extraction" is meant what is here called "correlation," or "correlated tables," in which the tables show the statistical relations of several points of inquiry. For instance, in the Massachusetts Census of 1885, in one table, sex, native and foreign born, and age periods are correlated with color and race and conjugal conditions, so that all possible relations of one of these points to all the other points can be seen on the same page.

In the United States Census of 1890 correlation will be carried to the ultimate. Such tables as the following will be presented: a classification by sex (2 details), native and foreign born (2 details), age periods (17 details), of place of birth (90 details), as regards occupations (350 details) with degree of illiteracy (3 details), and school attendance (2 details). More than *six million* correlations are required in this tabulation which can only be secured by the aid of machines. In the Irish census office the old method is followed by ruling tabulation sheets and tabulating in "blocks of five," that is, four perpendicular lines and one diagonal line to "bind" them together. This manner of work seems and is primitive when compared with the mechanical correlations secured in this country. One plan is followed in Ireland that is never used here in census work. That is to secure results by subtraction. In the United States all tabulations are proved to a total, and the aggregated details of each and every tabulation must prove that total.

CHAPTER IV treats of mechanical appliances which are comparatively few in number and limited in application as compared with those used in census work in this country. As has been explained, the old form of tabulating with tally marks is used in the Irish census office. Mr. Matheson has devised a way of folding tabulation sheets 4 feet 10 inches wide so that when they are folded they are but 2 feet 8⅝ inches wide, and easily reached by the clerks for horizontal additions. In the United States these horizontal additions would not be necessary, as the mechanical systems of tabulation give the desired totals at the same time that they supply the details. "Racks for cross-toting" are slips of paper or card board with spaces cut out so that certain columns only are shown for purposes of horizontal addition. This plan is sometimes used in the United States in filling totals into copy sheets.

Descriptions are given of Arithmometers which are used for multiplying, and for figuring percentages in conjunction with tables of logarithms. Slide rules are used for figuring ratios. These slide rules, from the illustration, do not seem to be as easily used as Thatcher's Cylinder Machine, which is largely used in the United States, or Hunt's Proportion, which is a circular disk, only 18 inches in diameter, and which is supplied with an adjustable microscope to aid in reading the necessarily small figures, destructive to the eyesight unless some such help is given.

From Mr. Matheson's description it is evident that the Arithmometer is not depended upon for those additions or aggregations which constitute fully 90 per cent of statistical work in this country, and which is done here by adding machines operated by electricity or by other mechanical aggregating devices.

CHAPTER V considers the publication of information. CHAPTER VI gives some very interesting particulars concerning the illustration of statistical works by diagrams, maps, plans, lithographs, and photographs. Mr. Matheson does not refer to, and perhaps has not seen, a South American statistical publication in which the *totals* in all tables are printed in *red ink*, the balance of the page being in black ink. CHAPTER VII gives particulars concerning the office staff, the employment of "boys and females" in statistical tabulations, and office arrangements and discipline. There is much material for consideration and opportunities for comparison in CHAPTERS V to VII which we are unable to consider fully here.

CHAPTER VIII is devoted to general remarks. Dr. Grimshaw is quoted, who thinks that "the same permanent department should be charged with the compilation of all the statistical work of the country . . . . and become practically a social intelligence department of the state." This remark applies strongly to the United States, where the census office should be made a permanent office. It would take such an office several years to put the national statistics of registration in proper shape. Such an office could take annual statistics of manufactures, such as are now being published by the Massachusetts Bureau of Statistics of Labor, and which could be made of invaluable service to the industries of the country. A simple enumeration of the people could be made once in ten years for the purpose of readjusting the representative districts, and a complete census could be taken also once in ten years, upon alternating quinquennial and decennial periods.

CHARLES F. PIDGIN

DIFFICULTIES IN ESTIMATING GOLD AND SILVER PRODUCTION.

Report of the Director of the Mint upon production of the precious metals in the United States during the calendar year 1888. James P. Kimball, Director. Washington: 1889. Pp. 246.

In estimating the production of gold and silver, the statistical difficulty is in determining the value of the bullion which is made into bars by private refineries for industrial use. To be sure for gold this is but a small proportion, and errors made on this point for the superior metal would not greatly disturb the conclusions. In 1888 the value of the gold product is estimated at $33,178,000, of which $1,633,000 was made into bars by private refineries for manufacturers and jewelers. From similar estimates made in the past three years it is the opinion of the bureau that the industrial employment of gold is increasing. In 1887 this use was reported as equal to $973,000; in 1886, $650,000; and in 1885, $1,272,000.